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Impact of Tracking Efficiency Measures on Selection of ETFs – A Study

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ABSTRACT

Tracking efficiency which is measured in terms of tracking error serves as an additional criterion while evaluating and selecting an index exchange traded fund. However, there is no universally accepted tracking error measure and use of alternative measures may lead to different selection by investors. The present study investigates the tracking efficiency of select Indian Index Exchange Traded Funds listed in National Stock Exchange based on daily NAV of ETFs for a five-year period from 1.1.2016 - 31.12.2020. Kendall's coefficient of concordance is calculated and tested for statistical significance. M50 index ETF appears to be the best among the lot for each of the sample years as well as for the overall period. The result clearly indicates that there is no association among the ranks given by different methods of measuring tracking error and hence the methods are independent. As a result, the investors need to exercise additional caution in using any one particular method over the others as this may involve error in selecting an efficient fund.

Keywords: Tracking efficiency, Tracking error, Exchange Traded Funds, National Stock Exchange

1. Introduction

It has been more than two decades that investment in mutual funds is considered to be one of best alternatives of investment. Mutual funds which are managed by professional experts often deliver returns more than the underlying index which it tracks. However, amongst all the types of mutual funds, the one which has gained global acceptance is Exchange Traded Funds (ETF). In particular, passively managed index based mutual funds have gained more popularity in relation to actively managed funds in recent times. Unlike traditional mutual fund schemes which are evaluated based on risk-return criteria, an investor should select a passively managed index ETF by considering how far the fund is able to track its benchmark. The more accurately an

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index ETF can track its benchmark, the more similar returns numbers it provides vis-à-vis its benchmark. This idea prompts the researcher to investigate the tracking efficiency of index ETFs.

2. Exchange Traded Funds: An overview

An investment security that passively replicates its benchmark like S&P500 is called an ETF. ETFs are a combination of securities comprising of bonds, stocks, other assets or gold, which resembles similar quality to that of mutual funds, more precisely index funds. But ETFs can be traded like stock in an exchange which is not true for mutual funds.

3. Concept of Tracking efficiency of ETFs

In order to judge which ETF is the best rewarding fund, we must first analyse its performance. The ETFs which are passively managed tries to track its benchmark in the same way as that of its index, so its performance can be best judged by evaluating its tracking efficiency rather than only studying its absolute or yearly return or risk. It remains the objective of every investor to select an ETF which would rightly track its benchmark and if there is deviation in the tracking efficiency of ETF, the investor tries to find an alternate fund. Although there are many measures to judge the tracking efficiency, but the main idea is that the extent to which an ETF return is different from its benchmark return is called tracking error.

4. Measurement of Tracking Efficiency

The following four methods of tracking errors are mostly accepted:

a. Root Mean Square (RMS) of Return Differentials: In this method tracking efficiency is analyses in terms of root mean square of return differentials as follows -

$$\text{TE 1= TE}_{\text{RMS}} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(r_{p,t} - r_{b,t})^2}$$

Where $r_{p,t}$ is the daily log return of ETF based on NAV for day t and $r_{b,t}$ is the benchmark for day t.

b. Standard Deviation (SD) of Return Differentials: TE is the standard deviation of daily differentials of returns as under -

$$\text{TE 2} = \text{TE}_{\text{SD}} = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(r_{d,t} - \bar{r}_d)^2}$$

Where $r_{d,t}$ =daily return differential i.e. $(r_{p,t} - r_{b,t})$.

c. Standard Error (SE) of Regression: Here TE is the standard error of regression of the return between ETF Return and Benchmark Return. Regression equation is as follows–

$r_{p,t} = \alpha + \beta\, r_{b,t} + \varepsilon_t$; where ε_t is the error term of the regression (here, TE 3).

d. Mean Absolute Deviation (MAD): This TE measure is the mean absolute deviation of the differentials of the returns (TE_{MAD}). TE is -

TE 4 = $TE_{MAD} = \frac{1}{T}\sum_{t=1}^{T}|r_{p,t} - r_{b,t}|$

5. Literature Review

Over the years, numerous studies have been conducted to investigate the tracking efficiency of index funds and ETFs across the world. The following are noteworthy in this context.

Frino and Gallagher (2001) analyzed the tracking error of index funds empirically. In their opinion, the major reason for tracking error of index funds is transaction cost. They also found a quarterly or seasonal pattern of tracking error of S & P 500 index funds. At the end of every quarter of the year, low tracking error was observed.

Phillippe Jorion (2003) examined active portfolios' risk-return relationship with tracking-error volatility (TEV) as a constraint. This TEV is nothing but value at risk. These constrained portfolios which are influenced by TEV follows an ellipse on the erstwhile mean-variance platform. This research gave rise to a number of new ideas. Due to flat nature of the ellipse, if we increase a constraint, the volatility of the total portfolio will greatly improve the active portfolios' performance. In case of general plan, sponsors should try to control risk of the total portfolio.

Athma and Kumar (2011) analyzed Indian ETFs and index funds' trends and performance in order to measure the performance of ETFs vs index funds. They opined that because of ETFs, small investors have gained more opportunity by investing with little amount of money in diversified portfolio, less amount of tracking error, lesser volatility and risk in consideration to the index funds.

Garg ang Singh (2013) empirically examined ETFs and index funds. They concluded that ETFs perform better in terms of tracking ability and replication strategy over long term. But there are potential limitations from the view point of investors so far as short-term investment is concerned.

6. Research Gap

On the basis of literature available, it may be summarized that -

(i). Research related to tracking efficiency of Indian index ETFs are limited in number and inconclusive.

(ii). Although there are many methods to analyze tracking error (TE), most of the researchers have relied upon only on Root Mean Square (RMS) of Return differentials.

(iii). It has not been examined whether the methods used for calculating TE will have significant impact on the selection of ETFs by the investor

7. Research Objectives

The primary objective of the study is to analyze whether the different tracking efficiency measures differ among themselves and whether a significant difference is there among them or not. It is backed by the following secondary objectives:

(i). Investigate the tracking efficiency of BSL Nifty, HDFCNIFETF, Kotak Nifty and M50.

(ii). To have a comparison of BSL Nifty, HDFCNIFETF, Kotak Nifty and M50 in terms of tracking efficiency

8. Research Methodology

(a) Data and Sample

The present study is empirical in nature and considers four widely traded index ETFs of Indian burses namely, BSL Nifty, HDFCNIFETF, Kotak Nifty ETF and M50 ETF. The data (both NAV and Price) for this study have been collected from the official websites of AMFI (Association of Mutual funds of India) and NSE (National Stock Exchange) respectively for a period from 1.1.2016 - 31.12.2020. All the ETFs have the same benchmark i.e., Nifty 50 Index.

(b)Research Methods

(i)Return calculation: Returns have been calculated on the basis of natural log difference between current and previous year price (ETF's NAV and closing Index for Nifty 50 Index).

Here, Daily ETF Return (R_P) = Log (P_t/P_{t-1})

Where, P_t = Closing price of ETF of day t, P_{t-1} = Closing price of ETF of day t-1

Daily Benchmark Return (R_B) = Log (I_t/I_{t-1})

I_t = Closing value of Benchmark index day t, I_{t-1} = Closing value of Benchmark index day t-1

(ii) Tracking Error (TE) calculation: All the four methods have been used to calculate tracking error of the ETFs as discussed in detail in the previous section.

(iii) Test of Association of Ranks among the different methods: In order to judge whether different TE methods are giving different opinions or not, Kendall's Coefficient of Concordance is applied on the ranks of 5 years under different methods and its significance is tested.

9. Empirical Findings

(a) Descriptive Statistics:

Table 1: Descriptive Statistics

	ETFS			
SUMMARY STATISTICS	BSLNIFTY	HDFCNIFETF	KOTAK NIFTY	M50
Mean	0.000441	0.000444	0.000428	0.000417
Median	0.000752	0.000726	0.000727	0.00068
Standard Deviation	0.011532	0.011612	0.011576	0.011545
Skewness	-1.77301	-1.74199	-1.75483	-1.74135
Kurtosis	29.01736	28.59032	28.84555	28.41132
Jarque Bera	34674.97	33544.68	34213.92	33085.09
Probability	0	0	0	0
Observation	1207	1207	1207	1207

(Source: Compiled by Researcher)

The results of the descriptive statistics show small positive returns. The return data is negatively skewed and has Kurtosis more than 3 which implies that it is Leptokurtic, a common characteristic of financial data. Jarque Bera statistics confirms that the data is not normal.

(b) Tracking Error Measurements

The tracking error measures have been summarised for each index ETF under study for each of the five years and for the entire 5-year sample period in the following tables.

Table 2: Results of Tracking Error for BSLNIFTY

YEARS	RMS	SD OF RET.DIFF	SE OF REGRESSION	MAD
2016	0.000275272	0.000275674	0.000124784	0.000183471
2017	0.000176528	0.000176016	0.000111757	0.00013299
2018	0.000612936	0.00061411	0.000612441	0.000189898
2019	0.003450491	0.003457593	0.003177616	0.000389956
2020	0.0001817	0.000181625	0.000163978	7.80121E-05
5 YEARS	0.001566109	0.001566722	0.001536626	0.000193681

(Source: Compiled by Researcher)

Table 3: Results of Tracking Error for HDFCNIFETF

YEARS	RMS	SD OF RET.DIFF	SE OF REGRESSION	MAD
2016	0.000127593	0.000127845	0.000124564	3.81376E-05
2017	5.22232E-05	5.17508E-05	5.14254E-05	1.67356E-05
2018	0.002378829	0.002383718	0.002360351	0.000485232
2019	3.12274E-05	3.1238E-05	3.00877E-05	1.28129E-05
2020	0.000127144	0.000126508	0.000126759	3.41242E-05
5 YEARS	0.001062497	0.000126508	0.001061803	0.000116567

(Source: Compiled by Researcher)

Table 4: Results of Tracking Error for KOTAKNIFTY

YEARS	RMS	SD OF RET.DIFF	SE OF REGRESSION	MAD
2016	0.000891814	0.000891666	0.000886993	6.86628E-05
2017	0.000723144	0.000722064	0.000710673	0.009414022
2018	1.42767E-05	1.30081E-05	1.06967E-05	9.2114E-06
2019	1.56028E-05	1.46769E-05	1.22437E-05	9.18935E-06
2020	0.000140389	0.000139491	0.000139685	3.85823E-05
5 YEARS	0.000516788	0.000516135	0.00051514	0.001907919

(Source: Compiled by Researcher)

Table 5: Results of Tracking Error for M50

YEARS	RMS	SD OF RET.DIFF	SE OF REGRESSION	MAD
2016	8.18424E-05	7.05648E-05	5.10714E-05	6.28715E-05
2017	9.77827E-05	6.79863E-05	5.68494E-05	7.80078E-05
2018	8.92095E-05	8.75023E-05	5.79968E-05	6.22604E-05
2019	6.17609E-05	6.13837E-05	2.55713E-05	4.3063E-05
2020	0.000218512	0.000217343	0.000176498	0.000109406
5 YEARS	0.000123505	0.000119034	9.33776E-05	7.12865E-05

(Source: Compiled by Researcher)

The above results clearly reveal that tracking errors under RMS, SD of Return Differentials and SE of Regression are fairly similar for each of the years for each of the four sample ETFs. However, the tracking errors for different years for each ETF is different for MAD method. This is because the calculation methodology does not require squaring the deviations.

On comparing the four ETFs, it is found that five-year tracking error is the highest for BSLNIFTY and lowest for M50 under RMS, SD of Return Differentials and SE of Regression. Under MAD the five-year tracking error is the highest for KOTAKNIFTY and lowest for M50. Thus, it appears that out of the four sample ETFs, M50 has been the most successful in replicating the performance of the benchmark.

(c) Testing the Association of Ranks among the different methods:

Though the tracking error results apparently seem to be similar for different methods, the same must be statistically tested for significance to make any conclusion. In case they appear to be statistically significant, ranking based on the same will also differ and that may have serious bearing on the investors' process of selection of ETFs. Thus, we apply Kendall's Coefficient of Concordance, a measure of association between k number of related samples. The results are given below.

Table 6: Test of Association

Ranks		**Test Statistic**	
Variable	Mean Rank	N	4
TE (RMS)	2.5	Kendall's W[a]	.012
TE (SD)	2.38	Chi-Square	.143
TE (SE)	2.5	df	3
TE (MAD)	2.63	Asymp. Sig.	.986
H_0: The ranks under different methods are not associated. H_1: The ranks under different methods are significantly associated.			

(Source: Compiled by Researcher)

The results show that p value is higher than 0.05 (p=0.986). Thus, the ranks under different methods are independent. Hence, different methods offer different ranks for the four sample ETFs. In other words, the method of measurement of tracking error has significant bearing on the investors' choice of ETFs.

10. Conclusion

Tracking risk measured by tracking error is an indispensable tool while evaluating an ETF and selecting one among the lot. Given the number of alternative methods available, the task becomes more difficult. In the present study, the tracking efficiency of ETFs have been judged based on four alternative tracking error measures. Under all the four methods, M50 emerges as the best ETFs among the lot. However, the relative performance of the ETFs is not same in other three methods. Moreover, the Kendall's Coefficient of Concordance Test clearly indicates that the ranks generated by the four methods are not associated i.e., they are independent and hence investors need to be further cautious in applying a particular method over the others in measuring the tracking error and consequently selecting an ETF for investment.

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